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NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION

OF THE

COLLEGE OF AGRICULTURE AND
MECHANIC ARTS

WEST RALEIGH

FEEDING EXPERIMENTS WITH COWS AND CALVES

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N. C. COLLEGE OF AGRICULTURE AND MECHANIC ARTS

THE NORTH CAROLINA

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The Bulletins and Reports of this Station will be mailed free to any resident of the State upon request.

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FEEDING EXPERIMENTS WITH COWS AND CALVES

By John Michels

NARROW VERSUS MEDIUM RATIONS FOR COWS.

In most sections outside of the cotton belt the cost of protein feeds is high in comparison with those of a carbonaceous nature. In the South with its abundance of cottonseed meal, protein is relatively cheap. Because of these facts, the work of the stations outside of the cotton belt has been directed mainly toward securing data as to how wide a ration can be successfully fed to dairy cows. Obviously, from what has been stated above, an important problem with the North Carolina farmer is to determine how narrow a ration can be successfully fed. The experiment reported in this bulletin, therefore, was undertaken with a view of determining the relative economy of a narrow ration and of a medium wide ration.[1]

PLAN OF EXPERIMENT.

The experiment was divided into three periods of twenty-eight days each. In periods I and III a narrow ration was fed consisting of 5 parts cottonseed meal, 4 parts wheat bran, 3 parts corn meal and 50 pounds corn silage. This ration had a nutritive ratio of approximately 1:4. During period II the ration was the same as in periods I and III, except that 2.5 pounds of cottonseed meal were replaced by 2.5 pounds of corn meal, giving this ration a nutritive ratio of approximately 1:5.7. Each period was preceded by ten days preliminary feeding.

Eight cows from three to six weeks in lactation were used for the experiment. Cows Nos. 6 and 7 received 9 pounds of grain; Nos. 1 and 4, 10 pounds; No. 2, 11 pounds; and Nos. 3, 5 and 8, 12 pounds. The grain was always fed before the roughage.

The milk from each cow was weighed daily, and composite samples of it were tested weekly by the Babcock test. The cows themselves were weighed once a week throughout the experiment.

RESULTS.

The results obtained from the individual cows during the different periods are presented in the following table:

[1] In a wide ration there is less protein in proportion to carbonaceous matter than in a narrow ration.

TABLE I—Showing Milk, Butterfat Test and Butterfat Yield and Live Weight.

No. Cow.	Period.	Milk.	Butterfat—Per Cent.	Butterfat—Pounds.	Average Weight of Cows—Pounds.
1	I. Narrow ration	560.8	5.1	28.6	756
	II. Medium ration	522.0	4.5	23.4	762
	III. Narrow ration	491.0	4.8	23.5	771
2	I. Narrow ration	622.9	5.6	34.8	837
	II. Medium ration	645.8	5.5	35.5	837
	III. Narrow ration	561.4	5.7	39.1	835
3	I. Narrow ration	857.8	4.4	37.7	702
	II. Medium ration	753.9	4.3	32.4	691
	III. Narrow ration	752.6	4.5	33.8	674
4	I. Narrow ration	555.5	5.4	29.9	788
	II. Medium ration	467.1	4.6	21.3	781
	III. Narrow ration	433.1	5.4	23.3	782
5	I. Narrow ration	761.9	4.0	30.4	932
	II. Medium ration	696.2	4.0	27.8	900
	III. Narrow ration	675.7	4.1	27.7	897
6	I. Narrow ration	455.7	5.8	26.4	856
	II. Medium ration	407.0	5.9	24.0	852
	III. Narrow ration	354.0	5.9	20.8	865
7	I. Narrow ration	432.1	4.6	19.8	748
	II. Medium ration	405.1	4.5	18.2	744
	III. Narrow ration	380.8	4.9	18.6	748
8	I. Narrow ration	761.6	4.3	30.1	1,004
	II. Medium ration	570.2	4.1	23.4	1,013
	III. Narrow ration	630.7	4.1	25.8	1,021

The results presented in Table I show that with one exception all cows produced more butterfat during the first period than during the second, while in the third period some cows produced a little more, and some a little less butterfat than was produced in the second period. The weight of the cows was practically the same throughout the experiment except of cows Nos. 3 and 8. Cow No. 3

gradually lost in weight, while cow No. 8 gained during the progress of the trial. Attention is also called to the test of the milk, which was perceptibly lower with most cows during the middle period than either during the preceding or following period.

The results of the experiment are brought out more forcibly in the following table:

TABLE II.—SHOWING TOTAL YIELD OF MILK AND BUTTERFAT AND TOTAL LIVE WEIGHT.

Period.	Milk—Pounds.	Butterfat—Per Cent.	Butterfat—Pounds.	Total Live Weight—Pounds.
I. Narrow ration	4,978.3	4.90	237.7	6,623
II. Medium ration	4,668.3	4.67	206.0	6,580
III. Narrow ration	4,279.3	4.92	205.6	6,593
Average of Periods I and III	4,628.8	4.91	221.5	6,610

Comparing the average results secured in periods I and III with those of period II it is found that the narrow ration produced 7.5 per cent more butterfat, increased the butterfat test 0.24 per cent and the total live weight 30 pounds. The milk yield was practically the same.

SECOND TRIAL.

The results of this trial are rather contrary to matters generally regarded as fairly fixed, namely, that the feed does not influence the richness of milk and that a fairly wide ration is more efficient than a narrow one. In view of this it was thought desirable to duplicate the work to see if the results obtained could be substantiated or reasonably duplicated.

In the second trial the kind, amount, and proportion of feed as well as the general method of recording results, were the same as in the first trial. To add strength to the results, however, it was thought best to reverse the feeding periods. In the first trial the narrow ration was fed during the first and third periods and the medium ration during the second period. In the second trial the medium ration was fed during the first and third periods and the narrow during the second. The number of cows in the first trial was eight, while only five were used in the second trial. The results obtained from the individual cows during the different periods of the second trial are presented in the following table:

TABLE III. Showing Milk, Butterfat Test, Butterfat Yield and Live Weight.

No. Cow.	Period.	Milk—Pounds.	Butterfat—Per Cent.	Butterfat—Pounds.	Average Weight of Cows—Pounds.
	I. Medium ration	519.1	5.60	29.20	852
1	II. Narrow ration	500.8	6.00	30.05	865
	III. Medium ration	468.8	6.15	27.83	876
	I. Medium ration	632.1	5.55	35.08	903
2	II. Narrow ration	591.3	6.06	35.83	890
	III. Medium ration	499.0	6.23	31.10	899
	I. Medium ration	752.8	3.7	27.85	934
3	II. Narrow ration	754.7	3.86	29.13	961
	III. Medium ration	617.1	4.15	25.61	993
	I. Medium ration	733.6	4.75	34.85	769
4	II. Narrow ration	648.0	5.62	36.42	765
	III. Medium ration	551.0	5.73	31.59	760
	I. Medium ration	636.7	4.48	28.49	794
5	II. Narrow ration	581.7	4.88	28.39	809
	III. Medium ration	536.1	4.77	25.45	820

The table shows that with one exception all cows produced more butterfat during period II when the narrow ration was fed, than in either the preceding or following periods during which the medium ration was fed. The exception is cow No. 5, which yielded slightly less butterfat in period II than in period I, but considerably more than in period III.

The rise in the per cent of butterfat is very marked in changing from the medium to the narrow ration, but far less so in changing from the narrow to the medium ration, indicating that the narrow ration tends to raise the per cent of butterfat in milk.

The yield of milk gradually dropped from the beginning to the close of the test except in the case of cow No. 3, which gave slightly more milk in Period II than Period I. Three cows gained in weight during the trial, while two lost slightly in weight, the loss or gain being uniform from the beginning to the close of the test.

The results of the experiment are brought out more forcibly in the following table:

TABLE IV.—Showing Total Yields of Milk, Butterfat, and Live Weight.

Period.	Milk—Pounds.	Butterfat—Per Cent.	Butterfat—Pounds.	Total Live Weight—Pounds.
I. Medium ration	3,274.3	4.82	155.47	4,252
II. Narrow ration	3,076.5	5.28	159.82	4,290
III. Medium ration	2,672.0	5.40	141.58	4,351
Average of periods I and III	2,973.1	5.11	148.52	4,301

Comparing the average results secured in periods I and III with those of period II it will be found that the narrow ration produced 7.6 per cent more butterfat, increased the butterfat 0.17 per cent and the amounts of milk 93.4 pounds, the live weight remaining practically the same.

COMPARISON OF RESULTS OF THE TWO TRIALS.

In regard to the yield of butterfat the results of the two trials are almost identical. In the first trial there was an increase of 7.5 per cent in butterfat yield in favor of the narrow ration; during the second period the increase was 7.6 per cent. The narrow ration also showed a higher per cent of butterfat in both trials, being 0.24 per cent higher in the first trial and 0.17 per cent in the second. The yield of milk was 0.8 per cent greater with the medium ration during the first trial, but during the second trial the narrow ration produced the more milk, being 3.4 per cent greater than that from the medium ration. The live weight of the cows was practically the same for both narrow and medium ration during both trials.

RELATIVE ECONOMY OF NARROW AND MEDIUM RATION.

So far as concerns the experimental results in this bulletin, a comparison of the "narrow" and "medium" rations is equivalent to a comparison of corn meal and cottonseed meal. It was learned that cottonseed meal (narrow ration) produced more butterfat than the corn meal (medium ration), when fed in the quantity and combination as reported in these trials. To get the full difference in the value of these two feeds, however, it is necessary to consider, in addition to their respective values as butterfat producers, also their market and fertilizing values.

It was stated at the outset that the ration fed during Period II was the same as that fed during Periods I and III, except that 2.5 pounds of cottonseed meal were replaced by an equal weight of corn meal. The cost of the former feed was 1.3 cents per pound, while that of the latter was 1.5 cents, making a saving of 0.2 cent per pound in favor of the cottonseed meal.

Comparing the two feeds solely on the basis of their fertilizing value it is found that cottonseed meal is worth 1.4 cents per pound and corn meal 0.38 cent per pound, a difference of 1.02 cents per pound in favor of the cottonseed meal. Adding to this the difference in the original cost of the two feeds, we find that each pound of cottonseed meal replaced by an equal weight of corn meal, effected a saving of 1.22 cents when both the original cost and the fertilizing ingredients are considered. But to this must also be added the increase in the butterfat production, which was found to be 7.5 per cent when 2.5 pounds of cottonseed meal were substituted for an equal weight of corn meal. Valuing butterfat at 30 cents per pound, the extra yield of butterfat increased the returns from cottonseed meal 0.9 cent for each pound fed in place of corn meal. Adding this to the 1.22 cents found above, we find that for each pound of corn meal replaced by an equal weight of cottonseed meal, a saving of 2.12 cents was effected for each pound so replaced. With a herd of ten cows fed one year under the conditions of the experiments detailed here, this would mean a total saving of $193.55.

HEALTH OF COWS.

So far as this experiment is concerned there was nothing whatever to indicate that a narrow ration (1:4) has any detrimental influence on the health of cows. In this connection it may be stated that no positive conclusions regarding this matter could be drawn from a short feeding experiment. The writer's data in reference to this point, however, are not limited to those obtained in the experiments detailed here; they cover four years work with from fifteen to fifty cows, which were fed on an average not less than six months a year on rations containing a nutritive ratio of about 1:4.[1] In all cases where such a narrow ration was fed, corn silage formed the main part of the roughage and we feel positive that no injury can be done a cow by feeding a narrow ration when corn silage forms the main part of the roughage, even when the narrow ration is obtained by feeding concentrates in which cottonseed meal forms the main part, provided, of course, that the meal is in first-class condition.

RELATIVE FEEDING VALUE OF COTTONSEED MEAL AND LINSEED MEAL FOR MILK PRODUCTION.

The experiment was divided into three periods of twenty-four days each, the first seven days of each period being counted as preliminary. In Periods I and III a ration was fed consisting of 10 parts wheat bran, 10 parts cottonseed meal, 5 parts corn meal, and 5 parts linseed meal. The grain ration during the second period dif-

[1] S. C. Sta. Buls., 117 and 131.

fered from this in that 10 parts of linseed meal were fed and only 5 parts of cottonseed meal. Of these grain mixtures, cows Nos. 1, 4 and 5 received 13 pounds daily, while Nos. 2 and 3 received 11 pounds daily. Each cow received uniformly 45 pounds of silage throughout the test. All of the cows were in the early stages of lactation.

The milk from each cow was weighed daily and composite samples of it were tested weekly by the Babcock test. The cows were regularly weighed once a week.

RESULTS.

The results obtained from the individual cows during the different periods are presented in the following table:

TABLE V.—Showing Milk, Butterfat Test, Butterfat Yield and Live Weight.

No. of Cow.	Period.	Milk—Pounds.	Butterfat—Per Cent.	Butterfat—Pounds.	Total Live Weight—Pounds.
1	I. Cottonseed meal	649.9	4.4	28.59	984
	II. Linseed meal	582.6	4.2	24.47	924
	III. Cottonseed meal	538.6	4.2	22.62	912
2	I. Cottonseed meal	370.5	4.1	15.19	992
	II. Linseed meal	342.3	4.1	14.03	995
	III. Cottonseed meal	326.4	4.2	13.70	970
3	I. Cottonseed meal	396.8	5.0	19.84	748
	II. Linseed meal	368.2	4.9	18.04	712
	III. Cottonseed meal	315.2	4.8	15.13	715
4	I. Cottonseed meal	470.2	4.4	20.68	865
	II. Linseed meal	470.4	4.5	21.16	849
	III. Cottonseed meal	476.9	4.5	21.46	855
5	I. Cottonseed meal	577.6	4.1	23.68	766
	II. Linseed meal	530.6	4.2	22.28	735
	III. Cottonseed meal	540.2	4.3	23.22	739

The table shows the yield of milk and butterfat gradually decreased throughout the test except with cows Nos. 4 and 5, which show a slight increase during Period III. The per cent of butterfat was practically the same throughout the test. There was also a decrease in live weight as the test progressed, except in case of cows Nos. 3, 4 and 5, which showed a slight increase during Period III.

The results of the experiment are brought out more forcibly in the following table:

TABLE VI.—Total Yield of Milk and Butterfat and Total Live Weight.

Period.	Milk—Pounds.	Butterfat—Per Cent.	Butterfat—Pounds.	Total Live Weight—Pounds.
I. Cottonseed meal	2,465.0	4.40	108.46	4,355
II. Linseed meal	2,294.1	4.38	100.48	4,215
III. Cottonseed meal	2,197.3	4.40	96.68	4,191
Average I and III	2,331.1	4.40	102.72	4,273

The table shows that the cottonseed meal gave slightly greater returns than the linseed meal. The difference, however, is so slight that it would seem unwise not to feed a small quantity of the linseed meal in place of cottonseed meal where there is the slightest need of the tonic effect which linseed meal is capable of producing. The cost of a ton of linseed meal averages about 15 to 20 per cent higher than cottonseed meal.

LINSEED MEAL AS A TONIC FOOD.

The great tonic value of linseed meal is evidenced by the fact that most of the so-called patent stock foods and condition powders are largely made up of linseed meal. It is a laxative feed and for this reason large quantities of it should never be fed as a daily ration. It is especially suited to young stock, being rich in growing material, such as protein and ash. Indeed there is no class of farm animals to which some linseed meal cannot be fed to advantage, especially when the animals are deprived for long periods of green or succulent feeds. Linseed meal takes the place of the high price patent tonic stock feeds and costs on an average only about one-tenth as much. Every well regulated stock farm should always be provided with linseed meal.

MISCELLANEOUS FEEDING TRIALS.

Observations have been made as to the effect of feeding cows a ration containing one-third cottonseed meal during the month preceding calving. No ill effects of such feeding were noticeable. It should be borne in mind, however, that the cows received a liberal amount of corn silage during the time these observations were made. Our feeding trials have well established the fact that cottonseed meal can be fed with much greater safety in conjunction with silage than with dry roughage.

In another investigation involving over twenty animals observations were made on the effects of feeding a grain ration, consisting

of one-third cottonseed meal, to heifers ranging from six to eighteen months of age. The daily grain allowance ranged from one and one-half pounds for the six months' old heifers to two and three-quarter pounds for the eighteen months' old heifers. The amount of meal fed in these trials did not appear to interfere in the least with the vigor and development of the animals. One-half of the roughage fed consisted of corn silage.

Investigations have also been made on the effects of feeding calves on old pasteurized milk and on skim-milk soured with pure cultures of lactic acid bacteria. In the main, the old pasteurized skim-milk did not appear to have any appreciable effect on calves, though the same had a tendency to produce scours when badly curdled. Feeding skim-milk sourced with lactic acid bacteria did not induce scours; on the contrary, such milk had an appreciable constipating effect. This constipating effect was so marked as to prove quite efficacious in checking calf scours. More data is needed to positively prove to what extent skim-milk soured with pure cultures of lactic can be used as a cure for calf scours.

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